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DSM-5 and Other Symptom Thresholds for ADHD: Which Is the Best Predictor of Impairment in College Students?

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Abstract

Objective: Approximately 5% of adults have ADHD. Despite recommendations regarding the diagnosis of emerging adults, there is not a strong consensus regarding the ideal method for diagnosing ADHD in both emerging and mature adults. We were interested in determining whether a threshold of four, five, or six ADHD symptoms would be associated with significantly different levels of functional impairment and be more or less indicative of a potential ADHD diagnosis. **Method:** We examined the relation between functional impairment and these ADHD symptom thresholds in 2,577 college students. **Results:** Our findings suggest that none of these symptom thresholds are differentially better at predicting functional impairment. **Conclusion:** The *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*) threshold of five symptoms for ages 17 years and older is not necessarily predictive of ADHD-related impairment in college students and may not be preferable to other thresholds. Options for resolving this diagnostic dilemma are discussed. *(J. of Att. Dis. XXXX; XX(X) XX-XX)*

Keywords

ADHD, emerging adults, *DSM-IV*, *DSM-5*, diagnostic criteria

In recent years, it has become widely accepted that ADHD is a chronic disorder that continues to produce significant functional impairment in adulthood for the majority of individuals with the disorder (Biederman, Petty, Evans, Small, & Faraone, 2010; Fischer, Barkley, Smallish, & Fletcher, 2005; Kessler et al., 2005). Approximately 5% of adults in the United States can be classified as having ADHD (Willcutt, 2012). In spite of the evidence that ADHD-related impairment typically persists into adulthood, and despite recommendations regarding what should be emphasized in evaluating young adults (i.e., collateral reporters, developmentally appropriate descriptions of symptoms; Sibley et al., 2012), there is not a strong consensus on the ideal method for diagnosing ADHD in this age group (McGough & Barkley, 2004). Indeed, it has been suggested that ADHD is underdiagnosed in this population (Kooij et al., 2010), which may be due to insufficient diagnostic utility of current criteria. Indeed, the underdiagnosis of ADHD, especially in college-enrolled adults, can lead to underutilization of academic accommodations and treatment services, and therefore, the question of accurate diagnostic criteria is an important one.

One issue that complicates the formulation of adult ADHD criteria is the heterogeneity of the presentation of ADHD over the life span. For instance, hyperactivity/impulsivity (HI) symptoms can be identified as early as the preschool years (Applegate et al., 1997; Arnett, MacDonald, & Pennington, 2013) and, once evident, often continue to be problematic through elementary school but diminish in adolescence and adulthood (Biederman, Mick, & Faraone, 2000; Mick, Faraone, & Biederman, 2004). In contrast, inattention (IA) symptoms usually do not emerge as problematic until children begin elementary school and are expected to pay attention for significant amounts of time (Applegate et al., 1997), but these symptoms often continue to be associated with impairment in adolescence and adulthood (Barkley, Murphy, & Fischer, 2008; Combs, Canu, Broman Fulks, & Nieman, 2014; Combs, Canu, Broman-Fulks, Rocheleau, & Nieman, 2012; Robin & Payson,

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2002). However, regardless of the difficulty of establishing appropriate criteria for emerging adults with ADHD, current *Diagnostic and Statistical Manual of Mental Disorders (DSM)* items were created based on studies of children (Lahey et al., 1994) and are therefore potentially unsuitable for use with adults.

DSM Adult ADHD

In the *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition* (*DSM-IV*; American Psychiatric Association [APA], 1994) and its *Text Revision* (*DSM-IV-TR*; APA, 2000), the same diagnostic criteria and threshold were applied to children and adults (i.e., at least six symptoms of IA, six symptoms of HI, or six symptoms of both for the Combined Type). However, these criteria were developed from research conducted exclusively with children and adolescents (ages 4-17 years; Lahey et al., 1994). Because of this, the developmental appropriateness of certain criteria (e.g., *doesn't listen when spoken to directly, fidgets with hands or feet or squirms in seat*, and *blurts out answers before questions have been completed*), the clinically significant symptom threshold (i.e., six or more symptoms in each or both clusters), and the overall diagnostic utility for adults have been questioned (Barkley, Murphy, & Fischer, 2008; Heiligenstein, Conyers, Berns, & Smith, 1998; Solanto, Wasserstein, Marks, & Mitchell, 2012).

Several changes were suggested for the most recent *DSM* in the years leading up to its publication in 2013 that were aimed at increasing the diagnostic validity for adults (Coghill & Seth, 2011). First, the possibility of including a different, more developmentally appropriate criteria set for adults was suggested (Barkley et al., 2008; Fedele, Hartung, Canu, & Wilkowski, 2010). Similarly, the inclusion of items that might have more utility for multiple age groups was considered. For example, it has been suggested that items tapping executive functioning be included (e.g., *trouble keeping track of multiple things, trouble planning ahead*; Barkley et al., 2008; Kessler et al., 2010; Murphy et al., 2001; Woods, Lovejoy, & Ball, 2002). In addition, four new items that measured impulsivity in a manner that was relevant for both children and adults were considered for inclusion (e.g., *act without thinking, rush through activities or tasks*; Ghanizadeh, 2012; Matte, Rohde, et al., 2015). Finally, a lower symptom threshold was considered for adults. In 1996, Murphy and Barkley recommended that the thresholds for adults (aged 17-29 years) be five for IA and four for HI, and others similarly suggested that a lower threshold was developmentally appropriate for adults (Matte, Rohde, et al., 2015; Murphy & Barkley, 1996; Solanto et al., 2012).

In spite of concerns about the diagnostic utility of *DSM-IV* ADHD criteria for adults, the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; APA, 2013) revision left the ADHD criteria largely unchanged. The changes made included adding parenthetical examples of adult behavior to the existing criteria (e.g., for the symptom *has difficulty sustaining attention, DSM-5* added a parenthetical example: not paying attention during lecture or lengthy readings), increasing the age of onset from 7 years to 12 years, and lowering the threshold for adults (ages 17 years and older) from six to five symptoms in HI and/or IA clusters. Notably, however, developmentally appropriate items were not among the changes made for the *DSM-5*. The impact of these changes is difficult to predict, given there was little existing empirical evidence for their adoption in the first place (Sibley, Waxmonsky, Robb, & Pelham, 2013). Therefore, empirical evaluation of these changes is necessary to ensure that they actually do *improve* diagnostic validity for older adolescents (age 17 years), emerging adults (ages 18-25 years; Arnett, 2000), adults (ages 26-64 years), and older adults (ages 65 years and older). A major contemporary longitudinal study of middle-aged adults (*M* age in late thirties; Barkley et al., 2008) has shown that the *DSM-IV* symptom criteria are not optimal at identifying individuals with ADHD in midlife. If this is similarly the case for the *DSM-5* criteria in emerging adulthood, a time when clinicians can reasonably expect initial referrals resulting in ADHD diagnoses (Faraone et al., 2006), then individuals presenting for evaluation may be under- or misidentified.

Since the publication of the *DSM-5* in 2013, Matte, Anselmi, and colleagues (2015) used the modified ADHD symptoms to conduct a field trial of 4,000 non-referred 18- and 19-year-olds in Brazil. Using the novel parenthetical descriptions and a requirement of onset by age 12 years, this research group found that five symptoms of IA and four symptoms of HI were the most appropriate cutoffs in this age group. Moreover, Matte, Anselmi, et al. (2015) reported that when using a cutoff of five symptoms compared with a cutoff of six symptoms, the prevalence of ADHD increased from 2.8% (*DSM-IV* prevalence rate) to 3.6% (*DSM-5* prevalence rate). This research group assessed ADHD-related impairment with one self-report item (i.e., how much impairment does ADHD cause; rated from *none* to *severe* on a 4-point scale). It is therefore important to not only independently replicate such findings in the United States but also more thoroughly measure functional impairment.

Impairment as an Indicator of Diagnostic Validity

Adults with ADHD report increased difficulties, when compared with their non-diagnosed peers, in a number of areas including physical health, academic performance, home responsibilities, money management, work performance, social activities, marriage and romantic relationships, and risky behaviors (e.g., substance use, driving; Barkley et al.,

2008; Nigg, 2013). Not surprisingly, the number of ADHD symptoms is positively correlated with functional impairment in adults (Mannuzza et al., 2011; Szuromi, Bitter, & Czobor, 2013). Even ADHD traits that are below the clinical diagnostic threshold have been shown to cause impairment across age groups (Balazs & Kereszteny, 2014; Faraone et al., 2007; Hong et al., 2014). Notwithstanding the new *DSM-5* threshold, what remains to be determined is whether adults with four or five symptoms of ADHD show sufficient impairment to justify a diagnosis.

The Current Study

In the current study, we examined the relation between functional impairment and ADHD criteria in emerging adults (i.e., ages 18-25 years) enrolled in universities in the United States. Academic problems are the most commonly reported ADHD-related impairment among adults (Barkley et al., 2008), indicating that college students with ADHD are an important at-risk group that merits specific focus with regard to the predictive nature of *DSM* symptoms. Specifically, we examined levels of impairment at different levels of ADHD symptoms. We were particularly interested in determining whether the presence of four, five, or six symptoms in the primary ADHD symptom clusters (i.e., IA and HI) was associated with meaningfully different levels of functional impairment.

Method

Participants

Participants were 2,577 undergraduate students enrolled at one of four universities (i.e., Appalachian State University, n = 1,072; University of Colorado Boulder, n = 494; University of Northern Iowa, n = 87; and University of Wyoming, n = 924) who participated in an online survey. Students with previous diagnoses of ADHD were allowed to participate regardless of whether they were taking stimulant medication for ADHD. However, those taking medication were asked to respond to survey items based on their non-medicated behavior.

Participants ranged in age from 18 to 25 years (M = 19.48, SD = 1.54). No exclusion criteria, other than age, were used. Of these participants, 65.8% were females. In terms of ethnicity, 84.0% of participants identified as European American, 2.5% as African American, 4.8% as Asian American, 1.3% as American Indian/Pacific Islander, 4.8% as Hispanic, and 2.6% as other or did not answer. On average, based on Fisher's exact tests, our sample was more female (p < .001) and slightly more European American (p < .05) than the demographics of the four institutions that were represented.

In addition, 10.9% of the sample reported a previous diagnosis of "ADD or ADHD," and 4.4% (data from only three of the four sites) reported use of stimulant medications. Comorbid diagnoses were not specifically assessed in the survey battery and were not a basis for exclusion.

Measures

Demographic information. The demographics form included questions about sex, age, race, ethnicity, number of years of education completed, past or present treatment (e.g., medication or therapy) for mental health problems (if applicable), and ADHD diagnosis, diagnostician, and age at diagnosis (if applicable).

Barkley Current Symptoms Scale. This self-report form includes nine *DSM-IV* IA symptoms, nine *DSM-IV* HI symptoms, and 10 impairment items (Barkley & Murphy, 2006). Impairment items assess the extent to which symptoms of ADHD impact functioning in multiple life areas (e.g., "In my home life with my immediate family," "In any educational activities," and "In my management of my daily activities"). All items required a choice among four responses (i.e., *never or rarely*, *sometimes*, *often*, and *very often*.) Internal consistency was calculated for the current sample and ranged from *good* to *excellent*; Cronbach's alpha values were .89 for IA, .85 for HI, and .92 for impairment. It should be noted that the *DSM-5* ADHD criteria are identical to the *DSM-IV* ADHD criteria. However, the *DSM-5* includes parenthetical examples of each item that were not included in the current study because the study was initiated prior to the publication of the *DSM-5*.

Barkley Childhood Symptoms Scale. This self-report form of childhood (i.e., ages 5-12) behavior also includes nine IA and nine HI symptoms (Barkley & Murphy, 2006). All items required a choice among four responses (i.e., *never or rarely*, *sometimes*, *often*, and *very often*). Internal consistency was calculated for the current sample and it was excellent; Cronbach's alpha values were .93 for IA and .91 for HI.

Weiss Functional Impairment Rating Scale. The Weiss questionnaire (Weiss, 2000) covers seven domains of functioning (i.e., family, work, school, life skills, self-concept, social, and risk) and consists of 70 items. Similar to the ADHD checklists, respondents are asked to indicate how much difficulty they have had in each area using a 4-point scale with response ranging from *never or not at all* to *very often or very much*. This second measure of impairment was included in the study because it is more comprehensive than the Barkley and Murphy (2006) measure and demonstrated strong psychometric properties. Internal consistency for the current sample was excellent (α = .96). Unlike the Barkley Impairment measure, individuals were not explicitly instructed to consider ADHD symptomatology when indicating levels of impairment.

Procedure

This study was approved by each of the four university's institutional review boards. Participants were recruited via Psychology department research pools. The first page of the online survey was the informed consent. This page included a description of the purpose of the study, procedure, duration, risks, benefits, and compensation. After reading this information, participants could consent to participate. Those who chose to participate were presented with the remaining measures. They completed the demographics form, Barkley Current Symptoms Scale, Barkley Childhood Symptoms Scale, and Weiss Functional Impairment Rating Scale. Finally, they were presented with a debriefing page describing the purpose of the study and the campus units to be contacted in case of further questions or concerns. Participants received 1 hr of credit toward a course requirement or extra credit.

Data Aggregation

For the Barkley Current and Childhood Symptom Scales, IA and HI items rated 0 or 1 (*never/rarely* or *sometimes*) were considered *not present* and items rated 2 or 3 (*often* or *very often*) were considered *present* (Barkley & Murphy, 2006). For current symptoms of IA and HI, these symptom counts were summed to create total scores ranging from 0 to 9 for each cluster. For childhood symptoms, these symptom counts were summed to create a total childhood ADHD score ranging from 0 to 18.

For the impairment measures, we calculated the mean score across 10 impairment items for the Barkley and the mean score across 70 items for the Weiss. Thus, total scores could range from 0 to 3. The Weiss Impairment total and Barkley Impairment total scores were significantly correlated ($r = .74$, $p < .001$).

Results

ADHD Symptom Counts and Impairment

To examine the relation between impairment and level of IA or HI symptoms, we conducted four one-way analyses of variance (ANOVAs) with ADHD symptom dimensions (i.e., IA or HI) predicting functional impairment (i.e., Barkley or Weiss).[1] We were interested in determining whether different symptom cutoffs would result in significantly different levels of impairment. Because we were most directly interested in comparing impairment at near-threshold levels (i.e., 3, 4, 5, or 6 ADHD symptoms), we combined participants with 0, 1, and 2 symptoms into a low symptom group and participants with 7, 8, and 9 symptoms into a high symptom group. This resulted in six levels of IA and HI for these analyses: (a) 0 to 2 symptoms, (b) 3 symptoms, (c) 4 symptoms, (d) 5 symptoms, (e) 6 symptoms, and (f) 7 to 9 symptoms. We then used Tukey's honest significant difference (HSD) procedure to conduct pair-wise comparisons among these six groups and control for the family-wise error rate.

Table 1. Barkley and Weiss Impairment Means by Inattention Symptoms.

		Barkley impairment (10 items)		Weiss impairment (70 items)	
Inattention	*n*	*M*	*SD*	*M*	*SD*
0-2	2,016	0.37[a]	0.40	0.36[a]	0.28
3	177	0.98[b]	0.50	0.68[b]	0.36
4	113	1.16[c]	0.52	0.82[c]	0.36
5	103	1.32[c,d]	0.49	0.94[c,d]	0.47
6	60	1.49[d,e]	0.48	1.07[d,e]	0.43
7-9	108	1.69[e]	0.55	1.18[e]	0.54

Note. Barkley and Weiss Impairment item responses ranged from 0-3. For inattention, 0-2 includes participants who self-reported 0, 1, or 2 symptoms of inattention; 7-9 includes participants who self-reported 7, 8 or 9 symptoms of inattention. Within each impairment measure, means with no common superscripts are significantly different ($p < .01$).

The ANOVA with IA symptoms predicting Barkley Impairment was statistically significant, $F(5, 2571) = 427.97$, $p < .001$, and produced a large effect ($\eta_p^2 = .45$). The results of the Tukey's procedure are shown in Table 1 via superscripts. As shown in Table 1, those with 7 to 9 symptoms did not report significantly higher levels of impairment than those with 6 symptoms ($g = .37$). In addition, those with 6 symptoms did not report significantly higher levels of impairment than those with 5 symptoms ($g = .34$). Similarly, those with 5 symptoms did not report significantly higher levels of impairment than those with 4 symptoms ($g = .33$). Those with 4 symptoms, however, reported significantly higher levels of impairment than those with 3 symptoms ($g = .34$), and those with 3 symptoms reported significantly higher levels of impairment than those with 0 to 2 symptoms ($g = 1.48$).

Similarly, the ANOVA with IA symptoms predicting Weiss Impairment was statistically significant, $F(5, 2571) = 285.23$, $p < .001$, and produced a large effect ($\eta_p^2 = .36$).[2] Again, the results of the Tukey's procedure are shown in Table 1, and the results followed the same pattern as that found for IA symptoms and Barkley Impairment; those with 7 to 9 symptoms did not report significantly higher levels of impairment than those with 6 symptoms ($g = .23$).[3] In addition, those with 6 symptoms did not report significantly higher levels of impairment than those with 5 symptoms ($g = .27$). Similarly, those with 5 symptoms did not report significantly higher levels of impairment than those with 4 symptoms ($g = .28$). Those with 4 symptoms, however, reported significantly higher levels of impairment than

Table 2. Barkley and Weiss Impairment Means by Hyperactivity Symptoms.

		Barkley impairment (10 items)		Weiss impairment (70 items)	
Hyperactivity	*n*	*M*	*SD*	*M*	*SD*
0-2	1,945	0.38[a]	0.42	0.37[a]	0.30
3	232	0.88[b]	0.53	0.63[b]	0.35
4	158	1.09[c]	0.55	0.77[c]	0.42
5	100	1.24[c,d]	0.64	0.88[c,d]	0.48
6	71	1.38[d]	0.57	1.02[d,e]	0.57
7-9	71	1.74[e]	0.58	1.18[e]	0.54

Note. Barkley and Weiss Impairment item responses ranged from 0-3. For hyperactivity, 0-2 includes participants who self-reported 0, 1, or 2 symptoms of hyperactivity; 7-9 includes participants who self-reported 7, 8 or 9 symptoms of hyperactivity. Within each impairment measure, means with no common superscripts are significantly different ($p < .01$).

those with 3 symptoms ($g = .39$), and those with 3 symptoms reported significantly higher levels of impairment than those with 0 to 2 symptoms ($g = 1.12$).

Next, the ANOVA with HI symptoms predicting Barkley Impairment was statistically significant, $F(5, 2571) = 308.58$, $p < .001$, and produced a large effect ($\eta_p^2 = .38$). The results of the Tukey's procedure are shown in Table 2. As shown, those with 7 to 9 symptoms reported statistically significantly higher levels of Barkley Impairment than those with 6 symptoms ($g = .62$). However, those with 6 symptoms did not report significantly higher levels of impairment than those with 5 symptoms ($g = .24$). Similarly, those with 5 symptoms did not report significantly higher levels of impairment than those with 4 symptoms ($g = .25$). Those with 4 symptoms, however, reported significantly higher levels of impairment than those with 3 symptoms ($g = .37$), and those with 3 symptoms reported significantly higher levels of impairment than those with 0 to 2 symptoms ($g = 1.17$).

Finally, the ANOVA with HI symptoms predicting Weiss Impairment was also statistically significant, $F(5, 2571) = 200.82$, $p < .001$, and produced a large effect ($\eta_p^2 = .28$). The results of Tukey's procedure are shown in Table 2. For this ANOVA, those with 7 to 9 symptoms did not report statistically significantly higher levels of Weiss Impairment than those with 6 symptoms ($g = .28$). In addition, those with 6 symptoms did not report significantly higher levels of impairment than those with 5 symptoms ($g = .27$). Similarly, those with 5 symptoms did not report higher levels of impairment than those with 4 symptoms ($g = .25$). However, those with 4 symptoms reported significantly higher levels of impairment than those with 3 symptoms ($g = .36$), and those with 3 symptoms reported significantly higher levels of impairment than those with 0 to 2 symptoms ($g = .87$).

Rate of ADHD Using Varying Cutoffs

In this community sample of college students, rates of ADHD were examined using both the *DSM-IV* and *DSM-5* ADHD Criterion A symptom threshold cutoffs, as well as a subthreshold level (i.e., 6, 5, and 4 symptoms, respectively; see Table 3). Without factoring in impairment or age of onset, at the cutoff of 6 symptoms (*DSM-IV* cutoff), the rate of ADHD in this sample was 9.3%. At the cutoff of 5 symptoms (*DSM-5* cutoff), the rate of ADHD was 14.7%. At the cutoff of 4 symptoms (i.e., subthreshold), the rate of ADHD was 21.3%.

Next, we added an age of onset requirement to our analyses. Specifically, the *DSM-5* criterion B dictates that "several" ADHD symptoms must be present before age 12 years. We interpreted this to mean that at least 3 symptoms of ADHD (i.e., IA and/or HA) must be endorsed in childhood. As seen in Table 3, prevalence rates at each of the cutoff levels were somewhat reduced when the presence of several childhood symptoms was also required.

Finally, we also considered impairment (i.e., *DSM-5* Criterion D) for the diagnosis of ADHD. We determined the impairment score on both the Barkley and Weiss measures that would place an individual at or above the 85th percentile. Scores above the 85th percentile are typically considered in the *at-risk* or *borderline* range (e.g., Behavior Assessment System for Children–Second Edition [BASC-2], Reynolds & Kamphaus, 2004; Child Behavior Checklist [CBCL], Achenbach & Rescorla, 2001). For the Barkley, this score was 1.20, and for the Weiss, this score was 0.88. Thus, individuals with mean scores equal to or higher than these values were considered to have at-risk levels of impairment (≥85th percentile). We then looked at the percentage of participants at or above symptom cutoff (i.e., 6, 5, or 4 symptoms) who were in this at-risk impairment range on the Barkley or Weiss measure. For the Barkley, 75.4% of participants with 6 or more ADHD symptoms had at-risk levels of impairment, 66.2% with 5 or more ADHD symptoms had at-risk impairment, and 54.7% with 4 or more ADHD symptoms had at-risk impairment. Similarly, for the Weiss, 62.9% of participants with 6 or more ADHD symptoms had at-risk levels of impairment, 55.1% with 5 or more ADHD symptoms had at-risk impairment, and 46.9% with 4 or more ADHD symptoms had at-risk impairment.

Finally, we calculated the rate of ADHD considering symptom cutoffs, childhood ADHD symptoms, and at-risk levels of impairment. As seen in Table 3, prevalence rates at each of the cutoff levels were reduced considerably when combined with the presence of several childhood symptoms and impairment data from the Barkley or Weiss measure.

Table 3. Prevalence Rates Based on Diagnostic Thresholds and Sequential Application of Age of Onset and Impairment Criteria.

	A		A + B		A + B + C1		A + B + C2	
	Symptom cutoff		Symptom cutoff + childhood symptoms		Symptom cutoff + childhood symptoms + Barkley impairment		Symptom cutoff + childhood symptoms + Weiss impairment	
Diagnostic threshold	%	*n*	%	*n*	%	*n*	%	*n*
≥ 6 symptoms	9.3	240	7.9	203	6.2	160	4.9	126
≥ 5 symptoms	14.7	379	11.9	306	8.5	219	6.6	170
≥ 4 symptoms	21.3	548	16.2	418	10.1	259	8.1	209

Note. A = symptom cutoff; B = "several" childhood symptoms (≥ 3); C1 = Barkley Impairment ≥ 85th percentile; C2 = Weiss Impairment ≥ 85th percentile.

Discussion

The results of the current study suggest that, in college students, the *DSM-5* symptom threshold of five ADHD symptoms is not readily distinguishable from the *DSM-IV* threshold of six symptoms or the alternatively proposed cutoff of four symptoms (Murphy & Barkley, 1996) in terms of self-reported impairment across two measures and multiple areas of functioning. In this sample, none of these thresholds can be considered clear dividers of *typical* and *disordered* behavior, though college students with six symptoms did report significantly more impairment than college students with four symptoms. Thus, the current findings suggest that it may not be possible to establish one threshold that is optimal for all individuals 17 years and older as is attempted in the *DSM-5*. Indeed, college students with four symptoms of ADHD were, statistically speaking, just as impaired as college students with five symptoms, and in the absence of developmentally appropriate symptoms, this may be the case for other subgroups of adults as well.

Alternate options for diagnosing adults with ADHD have been proposed. As mentioned previously, several researchers have suggested that separate, developmentally appropriate symptoms created specifically for adults would be ideal (e.g., Barkley et al., 2008; Fedele et al., 2010). Separate symptoms have been used in the *DSM* for other disorders (e.g., gender identity disorder in males and females, posttraumatic stress disorder [PTSD] and major depressive disorder in children and adults), and this possibility deserves continued study for ADHD.

Another option that has been proposed is to use normative data with regard to the distribution of ADHD symptoms in different age groups (DuPaul et al., 2016). For example, in our sample of college students, the 85th percentile for IA and HI would result in a cutoff of four symptoms, whereas the 92nd percentile would result in a cutoff of five symptoms. Of course, clinicians would still need to consider impairment in using these cutoffs, and we would not advocate a cutoff of four ADHD symptoms in the absence of significant, systematically assessed impairment. Our results suggest that about 50% of college students with four symptoms would reach the threshold for at-risk levels of impairment (54.7% on the Barkley Impairment measure and 46.9% on the Weiss Impairment measure). This normative distribution approach would be beneficial for certain groups, such as college students with ADHD, as some circumstances present particular challenges to one's executive functioning and result in significant impairment.

Furthermore, our results suggest that college students who self-report four or more symptoms of IA and/or HI should be evaluated further, in terms of functional impairment, and considered for a diagnosis. Because the executive functioning demands of higher education are so taxing, our data suggest that many college students with only four symptoms of ADHD are, in fact, highly impaired. Thus, we could identify a range of symptoms that would constitute further assessment of functioning. For example, clinicians could consider a diagnosis for adults who have four or more symptoms and use level of functional impairment as the deciding factor. Thus, an individual with four symptoms and a very high level of impairment might be given a diagnosis, as would an individual with six symptoms and a moderate level of impairment. For this type of a diagnostic strategy to be effective, more research is needed on the psychometric properties of measures of functional impairment as well as normative data to establish what constitutes *moderate* and *high* levels of impairment. This would provide clinicians with more objective measures of impairment.

It might be argued that considering a diagnosis of ADHD for college-enrolled emerging adults who have four, five, or six symptoms is equivalent to advocating for a cutoff of four, given that the *DSM* already requires significant impairment for a diagnosis. However, we are concerned that clinicians do not systematically evaluate impairment in part because psychometrically sound measures of impairment are either not available or not widely used. Thus, we are

proposing that more systematic measurement of impairment may help with this diagnostic dilemma in lieu of developmentally appropriate symptoms for adults. If we developed psychometrically sound measures of impairment and normed them across sex, age, and ethnicity, we would not have to rely so strongly on a specific diagnostic threshold. Rather, we could propose that a low range of symptoms (e.g., 0-3) would result in no diagnosis, a moderate range of symptoms (e.g., 4-6) would result in further evaluation of functioning and the need to rule out a diagnosis, and finally, a high range of symptoms (e.g., 7-9) would result in a diagnosis assuming all other criteria are met (e.g., age of onset, presence in multiple settings, and impairment). This system would encourage more systematic evaluation of impairment prior to making a diagnostic decision. It would also allow clinicians to be more sensitive to contextual factors, as college students with four symptoms might experience significant impairment, whereas an emerging adult with six symptoms in another context may not experience impairment.

There are several limitations of the current study. First, our sample was limited to emerging adults (ages 18-25 years) who were attending a 4-year college. On one hand, this is an important group to include because college students with ADHD symptoms tend to experience significant ADHD-related impairment (Norwalk, Norvilitis, & MacLean, 2009). On the other hand, the results of this study should be replicated with emerging adults who are not attending a 4-year college as well as more mature adults (i.e., above the age of 25 years).

Next, we did not conduct full diagnostic evaluations for ADHD or other mental health diagnoses. However, it is possible that the rates of ADHD in the current study may be an overestimate of the actual prevalence on college campuses. Indeed, the rates of ADHD presented by Matte, Anselmi, et al. (2015) were lower than those found in the current study. Matte, Anselmi, et al. conducted full diagnostic evaluations; whereas, in the current study, we considered symptom and impairment rating scales as well as childhood symptomatology but did not conduct clinical interviews, assess other diagnostic criteria (i.e., family history, symptoms in two settings), or obtain specific information about comorbid mental health problems in our sample. Similarly, we relied upon self-report of childhood ADHD symptoms, which may not be the most reliable way to obtain such information (Sibley et al., 2012).

In addition, our study may have been impacted by selection bias. Specifically, given that the title of our study indicated ADHD as the area of interest, it is possible that college students with ADHD (or ADHD-like symptoms) were more likely than students without ADHD to participate. The percentage of participants who reported a past diagnosis of ADHD was 10.9%, higher than the expected 2% to 8% (DuPaul, Weyandt, O'Dell, & Varejao, 2009). Thus, although we did not intentionally over-select students with ADHD, these students might have been more likely to participate. Therefore, although these data should not be used as an estimate of prevalence, they are still useful for the current purpose of examining levels of impairment at various ADHD cutoff scores.

Next, we were unable to collect collateral reports from an adequate number of participants in the current study, thereby limiting our ability to address the presence or absence of symptomatology across settings (i.e., Criterion C). Collateral reports of behavior and impairment are recommended in the diagnosis of ADHD in adults (Sibley et al., 2012). It will be important to develop strategies for recruiting higher numbers of collateral reporters from college students and replicate the current findings with collateral reports. Finally, we used the *DSM-IV* wording of the ADHD diagnostic criteria in the current study and not the *DSM-5* wording that includes parenthetical examples that may have more relevance for adults.

In summary, the results of the current study suggest that the new *DSM-5* cutoff of five symptoms of IA or HI for a diagnosis of ADHD in college-enrolled emerging adults is indistinguishable from a cutoff of four or six in terms of level of self-reported impairment. Thus, this new cutoff of five may not be the best for diagnosing ADHD in college students and possibly not for adults in general. Other thresholds and methods should continue to be explored. In light of our findings and their clinical implications, we recommend that researchers focus on the development and validation of standardized measures of impairment, as well as continue to explore developmentally appropriate symptoms for ADHD among adults. Furthermore, we suggest that clinicians consider diagnosing college-enrolled emerging adults who have four or more symptoms of IA or HI if they are also displaying at-risk levels of impairment.

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Notes

1. To test whether symptoms of anxiety and depression might have affected the pattern of results in analyses of variance (ANOVA) reported here, all analyses were rerun for a subsample (three of four campuses) that had included the Depression, Anxiety, and Stress Scale (DASS-21; Henry & Crawford, 2005) in their battery, controlling for such internalizing symptoms. There were *no* differences in the pattern of results.

2. For partial-eta square, a small effect size is $\eta_p^2 = .01$, a medium effect size is $\eta_p^2 = .06$, and a large effect size is $\eta_p^2 = .14$ (Cohen, 1988).
3. For Hedges' *g*, a small effect size is $g = .20$, a medium effect size is $g = .50$, and a large effect size is $g = .80$ (Cohen, 1988).

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